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LASER FREQUENCY STABILIZATION IN SEVERAL SPACE PROGRAMS

Abstract

Laser Frequency stabilization is a key technology for future on-board space instrumentation. Beyond the intended Strontium space-based cold atom clock, narrow-linewidth lasers are mandatory in optical metrology with promising applications such as NGGM laser transmitter in a post-GOCE (GRACE-like) implementation, and such as a system that provides stabilized laser source (enabling coherence length enhancement) for a free space optical frequency transfer.

Sodern is involved in some challenging developments. We report in this paper on the on-going development of a new frequency stabilized laser unit, which is part of the InfraRed Sounding (IRS) instrument, for the Meteosat Third Generation (MTG) mission. The main features of this laser concern its Size, Weight and Power consumption (SWaP), its robustness towards space environmental conditions, its ability to operate on-board autonomously without software assistance over a long timescale , and its overall system performance (radiometric, polarization, spectral). The Engineering Model of the MTG laser is going to be tested in the coming months; we will introduce preliminary results.

The activity: “thermal control system and mechanical suspension for cavity”, in relation to the European Space Agency GSTP “activity: “Optical Stabilising Reference Cavity (OSRC)”, has started in the frame of an Airbus DS contract and with an ultra-stable optical cavity developed by the UK’s National Measurement institute NPL.

We also provide an overview on the frequency stabilization of an infrared telecom laser operating at 1.5 m that is locked onto molecular iodine after efficient frequency tripling, which is realized at French Time-space Reference System (SYRTE) institute. It is partially developed in the frame of a PhD thesis co-funded by Sodern.